7-28-2011

2011 UAB Summer Research Expo

University of Alabama at Birmingham

UAB Summer Research Expo

July 28, 2011

WELCOME

Welcome to the **2011 Summer Research Expo**. This year's students have completed a wide array of projects, and we are confident that their work this summer will prove to be a step toward a promising future. Many thanks go out to the mentors who have overseen this summer's projects, as well as the judges who must select award recipients from the work presented today.

The undergraduate programs represented are UAB Summer Research Experience, UAB Honors Academy Prime Time Leadership Course, UAB Chemistry Research Experiences for Undergraduates (REU), UAB Department of Physics Research Experiences for Undergraduates (REU), Summer in Biomedical Sciences (SIBS) Undergraduate Research Program, and UAB Ronald E. McNair Post-Baccalaureate Achievement Program.

Our students this year represent 12 states and 20 institutions, including UAB, Auburn University, Talladega College, Columbia University, Northern Michigan University, Vanderbilt University, Stillman, College, Liberty University, Arizona State University, Virginia Tech, Lenoir-Rhyne University, Illinois Wesleyan University, University of Missouri-Columbia, Emory University, Pennsylvania State University, Rhodes College, University of Kansas, Morehouse College, Carson-Newman College, and Georgia Institute of Technology.

We hope that today's competing scholars continue their excellent work throughout their academic careers and beyond.

SCHEDULE

Thursday, July 28, 2011
Campus Recreation Center—Center Court

Poster Set-up	8:00 - 8:25
Judging of Posters	8:30 - 10:30
Open Poster Session and Awards	10:30 - 12:00
(poster removal—noon)	
Guest Speaker	1:00 p.m.

Dr. Larry DeLucas—Professor of
Optometry, Director of Center for Biophysical
Science and Engineering
University of Alabama at Birmingham
(HUC Alumni Auditorium)

2010 Summer Research Expo Award Recipients

Life Sciences I

Jack Bostron 1st Place	Eva Simanyi 2nd Place	Ian Justement 3rd Place	Michael Vincent Honorable Mention

Life Sciences II

Ryne Ramaker 1st Place	Nick Scalon 2nd Place	Christyna Malone 3rd Place	Andrew Ferretti Honorable Mention

Life Sciences III

Charles Taylor 1st Place	Courtney Sargent 2nd Place	LaKeshia Hyndman 3rd Place	Charlotte Mae Kent Honorable Mention

Life Sciences IV

Timothy Fernandez 1st Place	Rachel Stupay 2nd Place	Toral Patel 3rd Place	Larry Lawson Honorable Mention

Mathematics, Engineering & Technology

Chidinma Anakwenze 1st Place	Jose Roman 2nd Place	Amanda Haglund 3rd Place	Emily Smith Honorable Mention

Physical Sciences I

Kenneth Scott 1st Place	Andrew Davies 2nd Place	Joel Bloom 3rd Place	Andrew Ward Honorable Mention

Physical Sciences II

Max Grossnickle 1st Place	Matthew Bishop 2nd Place	Rylan Terry 3rd Place	Heather Hardeman Honorable Mention

Social & Behavioral Sciences and Public Health

Dominique Forte 1st Place	Vinetra King 2nd Place	Brianna Cameron 3rd Place	David Bala Honorable Mention

2011 Summer Programs

UAB Summer Research Experience

Ayushi Amin

UAB Honors Academy Prime Time Leadership Course

Dustin Bowen
Laura Ann Brown
Jarrod Collins
William C. Anderson
Alexandria Sheppard
Uma Srivastava
Danielle McDavid
Stephanie Arana
Rosalind Boonarkat

UAB Chemistry Research Experience for Undergraduates (REU)

Zacharia Ingram

UAB Department of Physics National Science Foundation—Research Experiences for Undergraduates (REU)

Evan Black
Kaitlin Bruegenhemke
Derek Caplinger
Stanley Cochran
Matthew Miller
Valentine Nwachukwu
John Owens
Sewada Reese
Rose Sackuvich
Kuni Scissum
Alex Skinner
Justin Smith
Hannah Whitaker
Nathaniel Wolanyk

Summer in Biomedical Sciences (SIBS) Undergraduate Research Program

Emily Courtman
BreeOna Ebrecht
Joshua Freda
Rebecca Garrett
Meredith Hubbard
Andrea Loes
QueenDenise Okeke
Jeremy Sheppard
Aneesh Tyle

UAB DoED Ronald E. McNair Scholars Program

Olamide Alakija
Selena Brown
Monee Casimir
Melissa Crook
Vincent Crump
Shannon Denny
Dominique Forte
Joshua Harris
Sharonne Hayes
Adrian Jones
Ashley Jones
Devanshu Kaushik
Alicia Kilgore
Vinetra King
Abigail Martin
Vincent McKitt
Minh-Thu Nguyen
Sierra Nicely
Ashruta Patel
Lorren Rice
Deondra Scott
John Smith
Crystal Taylor
Eva Trinh
Rashidra Walker
Melissa Walters
Vandrea Watts

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Honors Academy Leadership Projects

Life Sciences I—Exhibit 1

Selena Brown
UAB
McNair
Dr. Chenbei Chang, Dr. Shaonli Das, and Chih-liang Tien

Under-expression of PIAS in Early Xenopus Development

Protein inhibitors of activated STAT (PIAS) are proven to control activities of a number of different proteins and various processes such as cancer formation and immune response. PIAS have the capacity to bind directly to phosphorylated signal transducer and activator of Transcription (STATs) and reduce DNA-recognition and binding. The function of PIAS throughout vertebrate embryongenesis is far less understood. Therefore, last summer the full length copies of Xenopus PIAS 1-4 genes were attained using RT-PCR method and the expression patterns of the PIAS genes were analyzed using in-situ hybridization. It was found when PIAS levels were elevated; using microinjection of RNA, the mesoderm formation was disrupted. The overall nature of this research project is to examine the effect of reduced expression of PIAS proteins on early frog development. This will involve injecting frog embryos with antisense morpholino oligos to obstruct endogenous PIAS protein production. In addition, potential target proteins will be identified to distinguish if they can be modified by PIAS using Western blot assays. My role involves micro-injecting early stages of frog embryos, collecting embryos at the correct stages for in-situ hybridization or protein extraction, carrying out in-situ hybridization to examine gene expression, running protein gels, and performing Western Blot to identify SUMO-modified proteins.

Life Sciences I—Exhibit 2

Lorren Rice
University of Alabama at Birmingham
McNair Program
Mentors: Dr. Yuanyuan Li; Dr. Tabitha Hardy; Dr. Trygve Tollefsbol

The Effects of Poly E and EGCG on *E-Cadherin* gene expression in breast cancer cells

Approximately one in four cancers diagnosed in women in the United States is breast cancer, and an estimated 220,000 new cases of invasive breast cancer were diagnosed in women in the United States last year. *E-cadherin* is a tumor suppressor gene with significant effects on inhibition of tumor metastasis; furthermore, partial or complete loss of *E-cadherin* expression has been found to correlate with poor prognosis in breast cancer patients. Loss of E-cadherin communication differentiates the transition from benign cancer to invasive, metastatic tumorigenesis. Studies have been conducted to determine the therapeutic effects of green tea consumption on up-regulation of *E-cadherin*. Recent investigations have observed the epigenetic effects of EGCG, found in green tea, as well as a more stable combination of green tea derivatives called Polyphenon E (Poly E) on tumor suppressor genes. In this study we examined *E-cadherin* gene expression in MDA-MB-231 and MCF-7 breast cancer cell lines after 72 hour treatments with Poly E and EGCG. Preliminary findings suggest that optimal concentrations of Poly E and EGCG are capable of up-regulating *E-cadherin*; this regulation can allow for tumor suppressant and anti-metastatic activity in cancer cells. These results may lead to further investigation of the anti-carcinogenic properties and therapeutic effects of Poly E and EGCG and facilitate novel approaches for chemoprevention of various cancers. Future studies involving Poly E and EGCG are needed in order to confirm these results.

Life Sciences I—Exhibit 3

Meredith Hubbard
University of Alabama at Birmingham, Birmingham, AL
Summer in Biomedical Science (SIBS)
Mentor: Alecia Gross

Determining the Presence and Localization of Septin2 and Tulp1 in Rod Cells

Visual perception relies on the proper function of highly specialized neurons that sense light known as rods and cones. The rod outer segment (ROS) functions as the light-sensing organelle within rod photoreceptors and consists of thousands of membranous disks stacked within the plasma membrane. These disks form as vesicles produced within the cell body and are transported to the outer segment via the connecting cilium. Mutations within regions of the photoreceptor protein rhodopsin interfere with vesicular trafficking, leading to rod cell degeneration and the blinding disease autosomal dominant retinitis pigmentosa.

Based in part on findings from our lab and in others the carboxy-terminus of rhodopsin has been identified as the targeting element important for the proper trafficking of these vesicles due to its interaction with trafficking proteins in the inner segment and connecting cilium regions of the cell. We hypothesize a two-step mechanism of rhodopsin trafficking: the transport of vesicles containing rhodopsin from the Golgi apparatus in the inner segment through the connecting cilium to the outer segment and the assembly of these vesicles into disks at the base of the outer segment. While some of the proteins interacting with rhodopsin through both of these steps are known, some remain unknown and therefore the complete trafficking mechanism of rhodopsin bound vesicles and their assembly into disks is not completely understood. This project aims to determine the potential role of two known proteins, Septin2 and Tulp1, in the interaction with rhodopsin and trafficking of vesicles in both *Mus musculus* and *Xenopus laevis*. Presence of these proteins will be determined using Western Blot analysis and localization determined with Immunohistochemistry of retinal sections from both animals.

Life Sciences I—Exhibit 4

Crystal Taylor
University of Alabama at Birmingham
Ronald E. McNair Scholar's Program
Dr. Ching-Yi Chen and Blake Atwood

The Effects of KH-Type Splicing Regulatory Protein on Adipogenesis

Obesity has become a serious and growing public health problem and is a major risk factor for the development of metabolic disorders such as diabetes and atherosclerosis. Although much has been learned regarding the regulation of body weight and adiposity, the mechanisms underlying the control of adiposity are undoubtedly complex and the prevalence of obesity continues to rise. Identification of factors important for adipogenesis, i.e. differentiation of adipocytes from preadipocytes is thus critical to aid our understanding of the development of obesity and lead to the development of therapeutic strategies for treatment of obesity through the manipulation of adipogenesis. The KH-type splicing regulatory protein (KSRP) is an RNA-binding protein that regulates gene expression via mRNA decay. We have investigated how KSRP regulates adipogenesis and hypothesized that the absence of KSRP in the 3T3-L1 cells (pre-adipocytes) would result in decreased differentiation to mature adipocytes. To test this hypothesis, we downregulated KSRP expression in 3T3-L1 cells through RNA interference. Both control and KSRP-downregulated 3T3-L1 cells were differentiated by incubation with inducing reagents. Adipogenesis was assessed by oil-red staining to detect lipid accumulation and by analyzing the expression of genes critical for adipocyte differentiation. We found that cells with reduced KSRP expression exhibited less lipid accumulation as well as decreased expression of genes critical for adipocyte differentiation and lipid metabolism. These data suggest that KSRP plays a pivotal role in regulation of adipogenesis. These studies will provide crucial information that may allow for the prevention of obesity and diabetes through decreasing adipogenesis.

Life Sciences I—Exhibit 5

QueenDenise Okeke
Columbia University, New York, NY
Summer in Biomedical Science (SIBS)
Mentors: Tabitha Hardy, Trygve Tollefsbol

The Effects of Green Tea Component, EGCG, on Triple Negative Breast Cancer Cells

Statistical studies conducted by The American Cancer Society have shown that when compared to Caucasian (CAU), Native American, Asian, and Latin American women, African American (AA) women tend to have lower occurrences yet a higher mortality rate of breast cancer. African American women who develop breast cancer frequently have *estrogen receptor-α* negative (*ERα*-neg) tumors which makes cancer treatment more challenging. *ERα*-neg breast cancers have a poor prognosis because they do not respond to current hormone-targeted therapies which target the *ERα* pathway. However, studies have shown that (-)-epigallocatechin-3-gallate (EGCG), a polyphenol found in green tea, can prevent and inhibit various types of carcinomas. In addition, EGCG can reactivate *ERα* expression in *ERα*-neg breast cancer cells. We hypothesize that breast cancer cell lines derived from AA and CAU women show differential responses to EGCG treatment. To investigate this, breast cancer cell lines will be studied to determine the changes in cancer-related genes after treatment with EGCG. Cell lines will be treated with various concentrations of EGCG for three consecutive days. The cells will be collected, analyzed, and viability will be determined via 3-[4, 5-Dimethylthiazol-2-Yl]-2, 5-Diphenyltetrazolium Bromide (MTT) assay. Additionally, morphological differences will be assessed and changes in mRNA and protein expression will be detected via reverse transcriptase polymerase chain reaction (RT-PCR) and western blot analysis. Our findings reveal that EGCG can restore *ERα* expression, and this effect is enhanced when optimal dosages of EGCG are used. These results could help provide innovative and natural therapeutic applications for targeting the *ERα* gene in *ERα*-neg breast tumors of cancer patients using natural dietary ingredients like EGCG. Future studies, will be conducted to determine the long-term effects of EGCG treatment on breast cancer cells. Furthermore, natural dietary ingredients like EGCG may be used in addition with current chemotherapy agents to increase responsiveness of hormone-targeted therapies.

Life Sciences I—Exhibit 6

Vincent Mckitt
University of Alabama at Birmingham
Ronald E. McNair Post-Baccalaureate Achievement Program
Dr. Pittler

Assessment of Molecular Drug Therapy for the Treatment of Hereditary Retinal Degeneration

Nonsense mutations promote premature translational termination and cause anywhere from 5–70% of the individual cases of most inherited diseases (PTC Therapeutics, 100 Corporate Court, South Plainfield, New Jersey 07080, USA). .Nucleotide changes within an exon can alter the nucleotide sequence normally encoding a particular amino acid, such that a new "stop" signal is transcribed into the mRNA open reading frame. This causes the ribosome to prematurely terminate its reading of the mRNA, leading to nonsense-mediated decay of the transcript and lack of production of a normal full-length protein. Ocular diseases such as usher syndrome are caused by premature termination codons. We investigated the effectiveness of the read-through –inducing drugs PTC-124 and gentamicin in causing read-through in our premature termination codon construct. Both drugs were administered via sub retinal injections. Effecctive read-through of the premature termination codon would be indicated by fluorescence in the retinal outer segment of the specimen (murine) . If application of drugs show significant read-through, they could be considered therapeutic agents for ocular diseases.

BreeOna Ebrecht
Northern Michigan University, Marquette, MI
Summer in Biomedical Science (SIBS)
Mentor: John Hartman

A yeast model for development of CF therapeutics

Cystic fibrosis (CF) is an autosomal recessive disorder resulting from mutations of the Cystic Fibrosis Transmembrane Regulator (CFTR) gene, which serves as an ABC (ATP-binding cassette) chloride channel located on the plasma membrane. While there are over one thousand different mutations associated with CFTR in CF patients, the predominant mutation, accounting for approximately 70% of defective alleles and occurring in nearly 90% of CF patients, is a phenylalanine (F) loss at the 508 position (ΔF508), which prevents the protein from correct folding and biogenesis. The misfolded CFTR- ΔF508 is recognized by a protein quality control system associated with ER, and degraded through a process known as ER-associated degradation (ERAD). As a result, F508del-CFTR fails to reach the cell membrane, leading to physiological complications in CF patients. However, the CF phenotype varies too significantly to be well explained conclusively by the mutations in CFTR. This suggests that there are extragenic genetic modifiers of CFTR-ΔF biogenesis, which can be potential drug targets to correct the CF phenotype. To therapeutically correct the defects of misfolded CFTR- ΔF508 biogenesis, a panel of small molecular compounds are synthesized and tested in mammalian models and some of them displayed potential correction effect to the CFTR- ΔF protein. Unfortunately, the actual drug targets and potential molecular mechanisms that underlie the correction have not been fully revealed due to the fact that mammalian models are difficult and costly to study.

The yeast model, *YOR1* (Yeast Oligomycin Resistance), has recently been used to characterize CF disease. Similar to CFTR, there is deletion of the ΔF508 equivalent residue, ΔF670, in the first nucleotide binding domain (NBD) of Yor1, rendering the Yor1 protein misfolding and biogenesis defects. As an ABC transporter, Yor1 works as a drug pump to extrude the growth inhibitory drug – oligomycin (mitochondrial poison) from yeast cells. Therefore, we can monitor the correction of Yor1-ΔF670 protein by measuring and quantifying the yeast cell growth in oligomycin.

With this model, we are able to test the panel of CF compounds and screen for their potential drug targets and related biological pathways in yeast, which shares highly conserved pathways with mammals. There are two aims for this project, 1) expose the panel of corrector compounds to the yeast cells expressing Yor1-ΔF protein to identify promising compounds that work well with the model, and 2) analyze selected compounds in a genome-wide collection of yeast strains, each of which contains a single gene deletion and a regulatable *Yor1-ΔF* allele, to investigate potential related gene-drug interactions. Anther widely used CFTR- ΔF correction method, low temperature, will also be tested with this yeast model. The ultimate goal of this project is to further understand the biology of the compounds/corrections that could potentially be used in CF therapeutics.

Life Sciences II—Exhibit 8

Valentine Nwachukwu
Department of Biomedical Engineering
University of Alabama at Birmingham
Mentors: Romone Fancy, Tiara Napier, Yuhua Song*

Characterization of calmodulin and Fas interactions in Fas-mediated death inducing signaling complex

Fas-mediated signaling pathway is an important mechanism for apoptosis in a variety of cells, including cholangiocarcinoma and other cancer cells. The formation of death inducing signaling complex (DISC) is a critical step for Fas-mediated signaling. Recent experimental studies showed that calmodulin (CaM) binds to Fas and regulates Fas-mediated DISC formation and the binding of CaM to Fas is inhibited by the CaM antagonist, trifluoperazine (TFP) (J Cell Biochem, 103:788, 2008). The present study sought to characterize Fas binding affinity and the effect of Fas mutations and the effect of CaM antagonist, trifluoperazine (TFP), on CaM/Fas binding affinity. The results will be valuable to further elucidate the role of CaM in Fas-mediated death inducing signaling and provide a molecular mechanism for drug design of apoptosis mediators via CaM antagonism in the future. Isothermal titration calorimetry binding experiments were used to quantify CaM-Fas binding. Recombinant CaM and Fas DD protiens were expressed in *Escherichia coli cell* and purified. Purified CaM and Fas were gel-filtered prior to ITC experiments. We have quantified the wildtype CaM/Fas binding with ITC experiments. We will further quantify the binding of CaM/Fas V254N mutant and the binding of CaM/Fas C-terminal deletion mutant to determine the effect of Fas mutations on CaM/Fas binding. The effect of CaM antagonist, TFP, on CaM/Fas binding will be also determined with ITC experiments. Results from these studies will facilitate the identification of novel strategies and drugs capable of effectively regulating Fas-mediated apoptosis in cancer cells.

Life Sciences II—Exhibit 9

Emily Courtman
Auburn University, Auburn, AL
Summer in Biomedical Science (SIBS)
Mentor: Namasivayma Ambalavan, M.D.
Coworkers: Arlene Bulger BS, Teodora Nicola PhD.

Changes in transforming growth factor- β signaling and activation with stretching of mouse lung epithelial cells

Background: Many premature infants are born with severe respiratory problems resulting in high morbidity and mortality. Mechanical ventilation is sometimes necessary to ensure adequate gas exchange; however, it can cause lung injury. Ventilator induced lung injury (VILI) is considered to be due to volutrauma, or excessive stretching of the lung. Transforming growth factor- b (TGF-b) is a key regulator of growth inhibition, cell function, and extracellular remodeling that is involved in lung development and injury repair. It is possible that excessive TGF-b induced by volutrauma mediates VILI. **Hypothesis**: Increased stretching of mouse lung epithelial cells increases active and latent TGF-b, mRNA, and protein. **Methods**: Mouse lung epithelial cells (MLE-12) were cultured at passage 12 in HITES media. MLE-12 were plated at $6x10^5$ per well on 6 well matrix bonded ProNectin culture plates (Flexcell International) and grown until 80-90% confluent. The growth media was removed and replenished with new growth media. Cells were stretched at 5%, 10%, and 20% elongation for 6 hours using the Flexcell Tension System. Controls for each of the various stretching groups were also used. Conditioned media and cells were then removed for TGF-b protein (by western blot and ELISA) and mRNA analysis (by RT-PCR).

Life Sciences II—Exhibit 10

Olamide Alakija
University of Alabama at Birmingham
Ronald E. McNair Scholars Program
Mentors: Louis Dell 'Italia, M.D., Justin Barnes (grad student)

Assessment of Peroxisome Proliferator-Activated Receptor alpha in the Development of Volume Overload Induced Heart Failure

Heart failure is a major cause of death in developed countries, yet many of the mechanisms leading to failure have not been fully elucidated. Volume Overload is a heart condition characterized by excessive blood in the ventricles, often due to valve defects, and can eventually lead to heart failure. One potential mechanism that may lead to heart failure in volume overload is decreased fatty acid metabolism and a resulting "energy debt". Peroxisome Proliferator-Activated Receptor α (PPAR α) is a key positive regulator of fatty acid metabolism in the heart, but it's activity is lost in heart failure. However, gene therapy may offer a potential avenue for restoring PPAR α in the heart.

In this study we assessed the ability of a PPAR α-expressing plasmid to upregulate fatty acid metabolism in vitro. A second plasmid was created to make PPAR α perpetually active by fusion to the HSV VP16 gene (VP16 PPAR α). Analysis of fatty acid metabolism gene expression (*Fatty acid transport protein)* allowed us to compare the PPAR α activity provided by each plasmid in the R9c2 cardiomyoblast cell line. These constructs should sustain high levels of fatty acid metabolism in cardiomyocytes, making them good candidates for in vivo gene therapy experiments.

Life Sciences II—Exhibit 11

Ashruta Patel
University of Alabama at Birmingham
Ronald E. McNair Program
Mentor: Rita Cowell, PhD

The role of estrogen- related receptor α (ERRα) in PPARγ coactivator 1α (PGC-1α) mediated induction of parvalbumin (PV)

Peroxisome proliferator-activated receptor γ (PPARγ) coactivator 1α (PGC-1α) is a transcriptional coactivator involved in the regulation of energy production and utilization in metabolic tissues. Target genes are induced through PGC-1α coactivators and their ability to recruit at specific regulatory sites through interactions with nuclear receptors and additional transcription factors. Estrogen receptor related receptor (ERRα) is an orphan nuclear receptor that controls metabolism. Studies have established the activation of ERRα by PGC-1α or PGC-1β induces genes with roles in lipid transport, fatty acid oxidation, TCA cycle, oxidative phosphorylation, mitochondrial biogenesis, mitochondrial dynamics and oxidative stress defense. ERRα is a potential intermediate in PGC-1α action. PGC-1α coactivator properties allow it to control gene expression through specific DNA binding transcription factors at the promoters of target genes. Data from the Cowell lab indicate a role for the expression of the calcium buffer parvalbumin (PV) in the presence of PGC-1α. Inhibition of ERRα activity by its specific inverse agonist impairs the ability of PGC-1α to induce expression of energy metabolism genes and enhance mitochondrial biogenesis and oxidative capacity. The discovery of ERRα regulators and their selective effects on PGC-1α signaling can help determine additional gene regulation mechanisms by PGC-1α. ERRα is expected to transcriptionally regulate PGC-1α-induced genes where it can serve as a potential therapeutic target for the treatment of metabolic diseases, such as obesity, diabetes and metabolic syndrome. PGC-1α also plays a crucial role in metabolic regulation and reduced amounts have been hypothesized to cause neuronal vulnerability and mitochondrial defects in Huntington's disease.

Life Sciences II—Exhibit 12

Aneesh Tyle
Vanderbilt University, Nashville, TN
Summer in Biomedical Science (SIBS)
Mentor: Ilan Kerman

5-Hydroxytryptamine 1B Receptor (5-HT1B) expression in the human caudal brainstem in major depression.

Major Depressive Disorder (MDD) is one of the most common and harmful psychiatric illnesses in the US. Approximately 13% of Americans suffer from MDD during their lifetime. A great deal of depression-related research focuses on treating the cognitive and affective (or emotional) symptoms of MDD patients, as well as understanding the underlying brain dysfunction that causes these symptoms. However, depressed patients also frequently suffer other types of symptoms, such as chronic pain, cardiovascular problems, and motor difficulties. Our current research project aims to investigate the brain neural circuitry that may contribute to these more "physical" symptoms of depression.

There is abundant evidence of serotonin (5-HT) dysfunction having a major role in MDD. First and foremost - one of the most effective pharmacotherapies for MDD is to treat patients with medications that increase 5-HT function in the brain. Furthermore, previous human post-mortem studies have indicated that the organization of 5-HTergic neurons in the midbrain is altered in depressed patients. This work also revealed altered expression of certain genes involved in 5 -HT neurotransmission (such as the gene tryptophan hydroxylase 2 (TPH2), a key enzyme required for 5-HT synthesis) in certain brainstem nuclei of MDD patients.

The present study focuses on the 5-HT1B receptor, which is an autoreceptor expressed on 5-HT neurons and has the capacity to regulate 5-HT neuron functioning. In this study, we used brainstem tissue collected from human subjects either psychiatrically normal or diagnosed with MDD. The brainstem tissue was cryostat sectioned and processed for *in situ* hybridization, which utilizes a radioactive probe to detect the expression of 5-HT1B receptor mRNA. My role in the project was to quantify the 5-HT1B receptor mRNA expression by measuring mean signal and integrated optical density from audioradiograms that were exposed to the radioactive slides labeled for 5-HT1B receptor mRNA. My analysis focused on these specific brainstem regions: gigantocellular pars alpha nucleus, ventrolateral medulla, raphe magnus, raphe interpositus nucleus, raphe obscurus, and the paramedian raphe nucleus. We focused on these regions since a previous study revealed TPH2 mRNA expression abnormalities in these areas in MDD. Based on those earlier findings, we hypothesize that 5-HT1B mRNA expression will also differ between MDD patients and controls in one or more of these brain areas.

Life Sciences II—Exhibit 13

Monee Casimir
Stillman College
Ronald E. McNair Scholars Program
Mentors: H.M. Amm, Michael C. Guzelian, and M. MacDougall

Matrix Metalloproteinase Expression in Odontogenic Tumor Cell Populations

Ameloblastomas (AB) and calcifying epithelial odontogenic tumors (CEOT) are rare tumors thought to develop from the odontogenic epithelium and invade the jaw bone and local tissue. Keratocystic calcifying odontogenic tumors (KCOT) are also rare odontogenic tumors which are locally invasive, but do not invade the bone. The purpose is to compare expression of matrix metalloproteinase proteins (MMPs) between odontogenic tumors that invade the jaw bone and tumors that do not. MMPs are enzymes that degrade extracellular matrix proteins and play a role in normal and tumor cell migration. Certain MMPs have been shown previously to play a role in ameloblastoma bone invasion. **Objectives:** To determine which MMPs are involved in odontogenic tumor invasion. **Methods**: Previously developed primary cell populations from four ameloblastomas, four KCOTs, and one CEOT were grown in DMEM supplemented with 10% FBS and antibiotics. One sample for each tumor subtype (AB-1, KCOT-1, CEOT-1) were analyzed by cDNA microarray. Cells were collected and analyzed by quantitative real-time PCR (qRT-PCR), immunohistochemistry, and western blot to determine MMP expression. **Results:** MMPs were generally expressed broadly amongst tumor samples. MMP-1, MMP-3, MMP12, and MMP-16 were differentially expressed in tumor cell populations by microarray analysis. MMP-12 expression was increased in the KCOT tumor subtype compared to AB and CEOT tumors similar to microarray data. Differences in the expression of certain MMPs could be seen between tumor types. **Conclusion:** Distinct expression of MMPs may be involved in the differences in bone invasion observed amongst odontogenic tumors. **Support:** SOD IOHR, Ronald McNair Scholar Program.

Rebecca Garrett
Liberty University, Lynchburg, VA
Summer in Biomedical Science (SIBS)
Mentors: Boris Pasche, Jacquelyn Zimmerman

Novel Mechanisms for the Treatment of Breast Cancer: In Vitro and in Vivo Models

For illness currently without adequate treatment available, like insomnia, a therapy called low energy emission therapy (LEET) has been developed. This treatment through electromagnetic fields (EMFs) is thought to have application as cancer treatment. In a previous Brazil Phase I/II clinical trial, several patients experienced long term tumor responses (evaluated by regular CT scans or ultrasound with contrast). These specific, discrete frequencies are unique for each malignancy evaluated and appear to affect gene expression and mitotic division, inhibiting cellular dividing in vitro. Growth inhibition is observed only in cancerous cells, while normal epithelial cells are not inhibited, suggesting specificity of inhibition.

In vitro and in vivo studies are necessary prior to a US clinical trial, specifically a large Phase III randomized control study. Most importantly, in vitro and in vivo experiments aim to gain an understanding of the mechanism of action for this treatment approach For in vitro experiments, normal breast cell line MCF10A (as an example of normal epithelium exposed to EMFs) and cancer cell lines MCF7, SKBR3, and 231 will be used. Cells will be subjected to a 21 hour period of EMF exposure. Cells can then be harvested for gene expression assays and Western blots. Real time PCR will be done to assess changes in genes PLP2 and XLC2, which will be determined by using a PCR generated standard curve. Western blots will be used to assess differing levels of PLP2 protein between treatment/control groups and to show apoptotic influences.
Mice will be used as the in vivo test subject. T cell compromised mice (athymic nude mice) and Non Obese Diabetic SCID mice are purchased from Harlan labs and injected with breast cancer cells. As tumors grow, they will be measured and tumor volumes calculated. Using an sXv27 (System for eXposure in Vivo) machine, mice will be subjected to EMFs for longer exposures than the in vitro cells. The endpoint for these experiments is excessive tumor burden. Tumors in mice are measured M-F to observe change in volume. This type of treatment is a novel therapy which has yet to show severe side effects, a rarity in cancer treatments.

Life Sciences III—Exhibit 15

Minh-Thu Nguyen
University of Alabama at Birmingham (UAB)
McNair Post-Baccalaureate Scholar's Program
Mentor: Dr. Steven Pittler, acknowledgment: Hongjun Wei

Visualization of the Retina of Knock-in EGFP/Cngb1-X1 Knockout Hybrid Mice

Retinal degeneration is one example of an inherited disease. The human rhodopsin gene is linked to the neurodegenerative disease retinitis pigmentosa. This disease involves mutations at the C-terminus of the rhodopsin gene. This is important because rhodopsin is an essential component in the formation of the disks. To investigate retinal degeneration, we developed strains of mice that contained an enhanced EGFP fusion at the C-terminus in placed of the native rhodopsin gene. This knock-in of human rhodopsin-EGFP gene had shown retinal degeneration in homozygous mutant mice in a previous study. In our study, we will analyze mutant murine using this knock-in of rhodopsin-EGFP coupled with knockout homozygous Cngb1 gene locus. These mice will be used to analyze for imaging of rhodopsin distribution, membrane structure, disc morphogenesis, and possible identification of a timeline for disease state. The mice have been shown to develop degeneration of the disc that formed the rod photoreceptor at approximately 3 weeks (21 days old). Using the confocal and pseudoconfocal microscopy, we have observed that the degeneration of disc morphogenesis was also observed in heterozygous mice containing knock-in of rhodopsin-EGFP.

Life Sciences III—Exhibit 16

Andrea Loes
Arizona State University, Scottsdale, AZ
Summer in Biomedical Science (SIBS)
Mentor: Michael Niederweis
Coworker: C. M. Jones

Characterization of the periplasmic ferric binding protein of *Mycobacterium smegmatis*

Iron is an essential element for the growth of nearly all organisms. Bacteria have developed various acquisition systems to utilize iron in the environment. Here, we present the properties of MS3636, the periplasmic ferric binding protein of *Mycobacterium smegmatis*, a soil-dwelling, non-pathogenic microorganism often used in the study of *Mycobacterium tuberculosis*, the causative agent of T.B. It has been demonstrated that *M. smegmatis* has a low affinity ferric uptake system in which the inner membrane components display homology to the ferric uptake system of *Haemophilis influenza*e. In this study, we performed site directed mutagenesis on the periplasmic ferric binding protein MS3636 to elucidate amino acid residues necessary for iron binding. Mutant and wild type proteins were expressed in *Escherichia coli* and purified for comparison of iron binding. Iron binding was assessed by colorimetric assay and secondary structural analysis was performed with circular dichroism to verify proper folding of mutant proteins.

Life Sciences III—Exhibit 17

Kuni Scissum
University of Alabama at Birmingham
Research Experience for Undergraduates
Katie Culpepper, Susan Bellis

Enhancement of P22 bacteriophage delivery system binding to hydroxyapatite using a polyglutamate domain

Hydroxyapatite (HA) is a calcium phosphate crystal that makes up the mineral component of bone. HA can be produced synthetically, and is a commonly used biomaterial for coating implants and filling bone voids. In order to further improve HA performance, we explored the use of a protein delivery vector, bacteriophage P22, as a method to locally deliver high concentrations of bone morphogenetic protein-2 (BMP-2) to HA. In order to promote binding of P22 to HA, a polyglutamate domain was added to P22 and binding of enhanced P22 to HA materials was investigated. We discovered that adding diglutamate (E2) to P22 enhanced retention on HA disks and particulate HA. By packaging both P22 and E2-P22 with green fluorescent protein (GFP), we observed differences in binding and retention of protein cages by visualizing relative fluorescence. Using western blotting, we were able to see how much P22 or E2-P22 remained in solution after allowing binding. These studies showed that less E2-P22 remained in solution than P22, suggesting a greater initial binding to HA. Due to this enhanced binding, we believe E2-P22 could be an effective method of delivering osteoinductive protein BMP-2 (potent inducer of bone formation) resulting in enhanced osteoblastic differentiation and greater bone formation in vivo. Local delivery of protein on HA could have broad clinical implications as a method to enhance response to any biomaterial incorporating HA.

Life Sciences III—Exhibit 18

Josh Freda
Virginia Tech, Blacksburg, VA
Summer in Biomedical Science (SIBS)
Mentors: Robert Kesterson, Bradley K. Yoder
Coworkers: Sydney V. L. Armer, Raymond C. Pasek, Nicolas F. Berbari

Analysis of Hypothalamic Feeding Circuits in Response to Induced Loss of Primary Cilium in Adult Mice: ISH Characterization of NPY, POMC, AgRP, and MCH mRNA

Primary cilia occur on most cells of the mammalian system and contain vital biochemical pathways involved in the intraflagellar transport of protein complexes that contribute to the functioning of the cell. Ciliogenic genes, Tg737 and Kif3a, encode proteins necessary to maintain these pathways and their disruption in hypothalamic neurons is associated with changes in feeding behavior. Since Tg737 homozygous null mice are embryonic lethal, we used a model of conditional deletion of the loxP flanked Tg737 gene in adult animals (via activation of a tamixofen-inducible cre transgene). The resulting mouse models were analyzed in regards to three experimental conditions including the baseline condition, after obesity has set in (observed at a maximum of 64 days after tamoxifen injection), and after weight loss has been observed through a restrictive diet regimen. To unravel the underlying mechanisms by which loss of cilia lead to changes in feeding behavior, we will characterize neuroanatomical changes in gene expression of the well-established feeding circuits in the hypothalamus. We will use in situ histochemistry with radioactive antisense riboprobes of coronal sections of the hypothalamus to map mRNA levels of orexigenic (e.g. neuropeptide Y (NPY) and agouti related protein (AgRP) in the arcuate nucleus, and melanin concentrating hormone (MCH) in the lateral hypothalamus) and anorexigenic (e.g. proopiomelanocortin (POMC) in the arcuate nucleus) neuropeptide signals. Our overall hypothesis is that one or more orexigenic signals (NPY, AgRP, MCH) will be upregulated in the obese state (with POMC downregulated), and that these changes will be maintained in normal weight diet-restricted animals.

Life Sciences III—Exhibit 19

Vincent Crump
UAB
McNair Scholar's Program
MERIT Scholar Dr. Jessica Perez

Sox9 Protein Expression and Activity is Enhanced in Chondrocytes by TGF-β

Osteoarthritis is a disease of the articular cartilage that can be caused by pathological defects in chondrocytes. Studies have shown that there is a link between articular cartilage maintenance and Sox9 protein levels and have highlighted the role of TGF-β in the regulation of Sox9 expression. Studies indicate that Sox9 prevents late stages of ossification in chondrocytes, but the mechanisms are not well understood. Unlike the bone, the articular cartilage remains uncalcified and unhypertrophic. Understanding how Sox9 is regulated in its expression and activity can open avenues for clinical treatment for diseases of the articular cartilage, such as osteoarthritis. We hypothesized that the regulation of post-translational modifications, such as phosphorylation and sumoylation of Sox9 may impact its transcriptional activity. Our approach included the use of site-directed mutagenesis to alter the Sox9 phosphorylation site serine 181 into an alanine (S181A) on wild-type (WT) and sumoylation mutant (3XKR) vectors of Sox9. The bacteria were transformed to produce more of the mutanted DNA and selected by ampicilin resistance. The vectors with the desired sequences were transiently transfected into bovine articular chondrocytes with a luciferase reporter plasmid that contained the Sox9 elements for the collagen type II promoter (Col2a1) and the SV40 renilla luciferase reporter plasmid as a control. Lysates were obtained for the dual luciferase assay as well as to confirm overexpression of Sox9 by Western blot analysis. Our results confirm overexpression of Sox9 in cells transfected with Sox9 plasmids. We observed an increase in Sox9 in response to TGF-β as compared to controls and increased Col2a1 reporter activity when WT-Sox9 was overexpressed. We observed that the 3XKR-Sox9 had increased activity as compared to the WT-Sox9. Mutation of S181A in either background resulted in similar reporter activity to WT in the absence of TGF-β; however, reporter activity in S181A was enhanced in both backgrounds in response to TGF-β. These results dispel a role for Ser181 in the regulation of Sox9 activity in response to TGF-β and perhaps point towards other phosphorylation sites in Sox9 as potential targets of TGF-β.

Life Sciences III—Exhibit 20

Vandrea Watts
Talladega College
McNair Program Summer Research
Mentor: Dr. Stephen Barnes
Others involved in project: Kyle Floyd and Landon Wilson

Quantitave Identification of Alpha A-Crystallin C-Truncation Products in Rat Lenses

Cataract Disease is the leading cause of human blindness worldwide. Opacity occurs in the lens when there are alterations in the protein structure and water content. Once lens epithelial cells differentiate to form transparent fiber cells, they can no longer synthesize proteins. Protein truncation is considered to be a contributing factor to or a result of cataract formation. Previous studies have shown truncated αA-crystallin in both pre- and post-cataractous ICR/f rat lenses. However, the amount of specific truncation products within the lens is unknown. The goal of this study is to develop a method based on multiple reaction monitoring (MRM) mass spectrometry with electrospray ionization (ESI) to quantify the amount of truncation products within the lens with respect to full-length αA-crystallin. Rat lenses from different time-points of development were homogenized in 25 mM ammonium bicarbonate-8 M urea, pH 7.8, to recover water-soluble/insoluble proteins. After centrifugation and recovery of the supernatant each extract (10 μg protein) was treated with different proteases (chymotrypsin, Glu-C, trypsin, and combinations of these) to identify specific peptides that had undergone truncation. For the C-terminal region of αA-crystallin the 142-173 chymotrypsin fragment was most useful (^{142}SGPKVQSGL**D**AGHS**ER**AIPVS**R**EEKP**S**SAPSS^{173}) and allowed the independent detection of cleavage at residues 151, 156, 157, 163, and 168 (shown in **bold**). The full-length chymotryptic peptide was also detected. This peptide will be used to determine the relative proportions of the full-length and C-truncated αA-crystallin in ICR/f rats at several stages in the formation of cataracts.

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Life Sciences III—Exhibit 21

Devanshu Kaushik
University of Alabama at Birmingham
McNair Program
Dr. Andra Frost, Dr. Kun Yuan

Transforming Growth Factor-β Reduces the Occurrence of Primary Cilia in Human Ovarian Cancer Cell Lines

Primary cilia (PC) are solitary microtubule-based sensory organelles that are present in most cell types. They are physical-chemical sensors that monitor multiple extracellular stimuli and relay signals. PC are now known to participate in cell migration, in establishing polarity during organogenesis, and in the maintenance of homeostasis. A decrease of PC occurrence has been identified in several human cancer cells, although little is known about the mechanisms underlying this loss of PC in malignancy. During tumorigenesis and progression, epithelial cells undergo an epithelial to mesenchymal transition (EMT), characterized by decreased expression of epithelial markers and acquisition of mesenchymal markers as well increased motility and invasiveness. Transforming Growth Factor-β (TGF-β) is a well-known inducer for EMT in epithelial cells. We have found that incidence of PC decreases in some breast cell lines after treatment with TGF-β. We are extending this work to study the occurrence of PC in ovarian cell lines. SKOV3 is an ovarian cancer cell line derived from ovarian epithelium. TGF-b (10 and 40 ng/ml) was used to treat SKOV3 cells for different duration. We used immunofluorescence for α-acetylated tubulin to evaluate the occurrence of PC, and for vimentin as a indicator of EMT. Ki-67 staining was used to measure cell proliferation. Our preliminary data suggest that TGF-β decreases the occurrence of PC in SKOV3 ovarian cancer cells, similar to breast cells. This finding may help us to explore the potential pathological significance of the loss of PC in the progression of ovarian cancer.

Life Sciences III—Exhibit 22

Melissa Walters
University Of Alabama at Birmingham
Ronald E McNair research program
Mentors: Dr. John Shacka and Leandra Mangieri

Effects of Bafilomycin Analogs on Cell Death and Autophagic Vacuole Accumulation

Parkinson Disease (PD) is the second most common age- related neurodegenerative disease. PD disrupts motor functions through selective degeneration of dopaminergic neurons within the substantia nigra. Alpha synuclein (ASYN) - containing Lewy bodies are a pathological hallmark of PD, and studies show that ASYN may accumulate via disruption in the autophagy- lysosome pathway (ALP). The ALP is an important intracellular pathway that promotes efficient degradation of cytoplasmic contents that the cell uses for energy. We have shown previously that the drug Bafilomycin A1 (BafA1), a macrolide antibiotic, enhances cell survival upon treatment with cell death stimuli, in a manner consistent with preservation of the ALP and promoting clearance of ASYN. However, at higher concentrations, BafA1 inhibits the re-uptake of protons that bind to the C-subunit of V-ATPase. As a result, lysosomal pH is no longer maintained, thereby leading to a robust decrease in cell viability. In the current study, using SH-SY5Y human neuroblastoma cells, results show that cells treated with BafA1 have a lower cell survival rate compared to BafD (an analogue of BafA1) treated cells at the same concentration. These data suggest that the structural difference of BafD may allow it to be given at higher concentrations without causing neurotoxicity otherwise seen in BafA1 treated cells. These findings suggest that BafA1 and its derivatives may be useful tools in pre-clinical models of PD for delineating ALP- specific targets that promote clearance of toxic ASYN species.

Social & Behavioral Sciences and Public Health I—Exhibit 23

Abigail Martin
University of Alabama at Birmingham
Ronald E. McNair Post Baccalaureate Achievement Program
Mentor: Despina Stavrinos, PhD
Coworkers: Crystal A Franklin, MPH & Philip R. Fine, PhD, MSPH
University of Alabama at Birmingham - University Transportation Center (UAB-UTC)

Misperceptions of Distracted Driving Ability and Risk Among Teens with or without ADHD

Statement of Purpose: To examine the relationship between perceived ability and risk while engaging in distracted driving among individuals with or without ADHD. **Introduction**: Teens, especially those with ADHD, tend to overestimate their driving ability and underestimate crash risk, a phenomenon known as "optimism bias." When overestimating their ability, teens may engage in risky behavior such as distracted driving, more frequently. **Methods**: 43 teens (nADHD =22; ncontrol =21) completed the Questionnaire Assessing Distracted Driving. Perceived ability and risk were measured on 5-point Likert scales. Bivariate correlations examined the relationship between perceived ability and risk variables for the overall sample and separately for each group. **Results**: Teens perceiving their ability to drive while distracted as "better than their peers", also perceived the activity less risky. For individuals with ADHD, the higher the perceived ability to text while driving, the less risky this activity was perceived. Among controls, the higher the perceived ability to email and talk on a cell-phone while driving, the less risky these activities were perceived. **Discussion**: These results suggest teens generally overestimated their ability to engage in distracted driving which may have influenced responses rating texting, talking on a cell-phone and emailing while driving as *less risky*. Future prevention efforts focusing on young drivers should consider ways to debunk misperceptions through targeted pre-licensure awareness programs. Also, driving simulators may provide another mechanism for safely demonstrating, to new drivers, dangers associated with distracted driving.

Social & Behavioral Sciences and Public Health I—Exhibit 24

Melissa Crook
University of Alabama at Birmingham
Mentors: Dr. Susan Davies and Dr Terri Lewis

Determining factors that lead to HIV disclosure from parent to child

As treatment has evolved and improved for people living with HIV/AIDS, more people are living longer which creates new obstacles in addressing how to manage challenges that emerge from living with the disease. A large number of people who are HIV positive are also parents, presenting a whole new realm of possible difficulties and struggles. At the fundamental core of these issues is the decision of whether or not to disclose HIV status to a child. The Making Our Mothers Stronger (MOMS) Project was an intervention study focused on improving parental-related stress in HIV positive mothers. Using data from this project, analyses was conducted to examine the influence of demographic and family factors on a mother's disclosure of her HIV status to her children. Recruited from HIV clinics in Alabama, 108 women over age 18 with at least one child between four and twelve participated in the study. Baseline demographic information regarding maternal age, marital status, number of children, and severity of symptoms were examined to determine the association of these factors with HIV/AIDS status disclosure to children. Analyzing data using individual linear regression shows significance in respect to race, being married, having higher number of children, older maternal age, and health status; however being diagnosed during pregnancy has no significance. When combined into a fully controlled model the only factors that remain significant are number of children and maternal age. This finding can be useful in the future for successfully designing intervention programs targeted at HIV positive parents.

Alicia Kilgore
UAB
Ronald E. McNair Postbaccalaureate Achievement Program
Mentors: Michael Gower and Dr. Fred Biasini

Investigating the Role of Clinical Opinion in Diagnosing ASD when ADOS and ADI Classifications are Discrepant

In the United States autism spectrum disorder (ASD) is the fastest growing developmental disability, currently affecting an estimated 60 per 10,000 children (Chakrabarti & Fombonne, 2005). Early diagnosis can lead to early intervention which has been shown to help reduce developmental delays such as cognitive and language functioning as well as behavioral and adaptive problems in children with ASD (Hopkins et al., 2011). Currently, two "gold standard" measures are utilized to help diagnose ASD: the Autism Diagnostic Observation Schedule (ADOS), an observational measure administered by a licensed psychologist, and the Autism Diagnostic Interview (ADI) which relies on evaluative input from parents/caregivers and their reports of the child's current and past behaviors (Lord et al., 2000; Lord, Rutter, & Le Couteur, 1994). Often, these two measures show a discrepancy in the severity of autistic symptomology. Ideally, in this case, professionals from interdisciplinary fields come together to administer additional evaluative test and to discuss the outcomes for each measure in order to determine a final diagnosis (Ventola et al., 2006). The purpose of this study was to investigate the relationship between cognitive functioning, performance on behavioral measures, and language skills for a group of children with discrepant severity scores on the ADOS and ADI. A discriminate functional analysis (DFA) was performed in order to observe the nature of these relationships. Data was collected between 2006 and the present and was pulled from a database in an interdisciplinary clinical setting, the Civitan-Sparks Clinic at UAB.

Ashley Michelle Jones
University of Alabama at Birmingham
Ronald E. McNair Postbaccalaureate Achievement Program
Dr. Jacqueline Wood, former English Literature Professor

Reconstructing Sonia Sanchez: Bibliographical Research on the Life of a Writer

Sonia Sanchez is a widely renowned poet and activist whose work has been discussed in various critical journals. Despite her fame as a poet, many aspects of Sanchez's life and work remain largely untouched. Dr. Jacqueline Wood of the UAB English Department, is one of the frontrunners in a new wave of research on Sanchez's life and drama. Wood's recent publication, *I'm Black When I'm Singing, I'm Blue When I Ain't and Other Plays by Sonia Sanchez* is one such effort. Wood is currently working on a biography of Sanchez. This research is directly linked to this multi-year project. The purpose of this project is to conduct preliminary research by gathering various articles that will assist in the reconstruction of Sanchez's life. The assembly of extensive bibliographies of all mentions of Sanchez in print were done by using research databases such as Modern Language Association National Bibliography, JSTOR Journal Storage, LexisNexis Academic, and catalog resources. Upon completion of this project, a compilation of a nearly exhaustive bibliography (with hard copies of each article) of relevant mention of Sonia Sanchez will be assembled.

Dominique Forté
University of Alabama at Birmingham
McNair Scholars Program
Mentor: Dr. Matthew P. Ford, PT, PhD

Gait Training for Persons with Parkinson's Disease using External Auditory Cues

Parkinson's disease (PD) is the result of approximately 80% loss of dopamine producing cells in the brain. Individuals with PD tend to walk slower. They take shorter steps at a faster rate, in comparison to a healthy adult. However, walking improves after participation in a structured mobility-training program. The goal of this study is to determine if the use of music with higher rhythm rates during a walking training program will increase average speed, stride length, and average cadence, in comparison to training with music set at more comfortable rhythm rates. Participants were randomized into one of three groups. The control group walked at a comfortable pace without music. The music group walked to a playlist whose bpm matched their comfortable cadence, and the progressive group walked to music with a bpm that was systematically increased. Participants in each group trained by walking 30 minutes each session, 3 sessions a week for 6 weeks around a 200-meter track. Participants listened to music through an Apple iPod nano with headphones. A Polar heart rate monitor was used to measure the changes in heart rate during the 30 minute training session. We gathered information regarding participants' health history, recent falls, PD related symptoms, balance, and functional mobility. To date, we have collected data from 12 participants, and based on this data, we expect that individuals who train at higher rhythm rates will show greater improvements with walking speed.

Eva Trinh
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Mentors: Gitendra Uswatte, Brad Sokal, Rex Wright, Edward Taub, Victor Mark,
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Correlation of Effort with Motor Capacity and Daily Arm Use in Upper-Extremity Deficit after Brain Injury

Patients with acquired brain injuries, such as a stroke, or neurological diseases, such as multiple sclerosis (MS), typically have hemiparesis: spasticity, muscle weakness, and persistent deficit in motor coordination on one half of the body. Very little is known about the amount of effort it takes to move a paretic arm in individuals with an asymmetric upper-extremity deficit. This project aims to understand the relationship between effort required to move that arm with how rapidly patients can complete motor tasks and how much patients use that arm in everyday life. Four stroke survivors and 12 individuals with MS moved a peg from a starting hole to a target and back with their more affected arm for 60 seconds. Effort to move the more-affected arm was measured by collecting cardiovascular indices of effort, systolic blood pressure (SBP) and heart rate (HR), and by the Category-Ratio 10 (CR10) self-report scale. Measurements of effort were compared with the more-affected arm's motor capacity, assessed by Wolf Motor Function Test (WMFT) performance times, and the more-affected arm's use in daily life, as assessed by Motor Activity Log (MAL) Amount of Use (AOU) scores. Weak correlations were found for greater WMFT performance time with greater changes of SBP and HR and lower scores of CR10 (SBP: $r = 0.21$, $p = 0.50$; HR: $r = 0.33$, $p = 0.26$; CR10: $r = 0.27$, $p = 0.37$). A weak correlation was found for greater AOU scores with lower HR values ($r = 0.20$, $p = 0.46$).

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University of Alabama at Birmingham University Transportation Center

Cell Phone Application Use and Types Among Young Distracted Drivers

Statement of Purpose: To examine the frequency of use and specific types of cell phone applications ("apps") used while driving among teens and young adults

Background: Distracted driving (DD) is a major contributor to fatal crashes.[1] Previous research has focused on various forms of distraction including cell phone conversation, texting, and passengers.[2] The present study is among the first to examine the impact of an emerging form of DD, the use of cell phone applications.

Method: 75 individuals (*M* age = 21 years) participated in a larger study assessing the impact of DD on simulated driving performance. Use of cell phone applications while driving was measured by the Questionnaire Assessing Distracted Driving (QUADD).[3-4] Qualitative data regarding the specific types of applications were also obtained. Descriptive statistics will be presented.

Expected Results: The majority of drivers will report using cell phone applications while driving. Given the rise in popularity of social networking among teens and young adults, we hypothesize that the most frequently reported application while driving will be Facebook.

Potential Impact/Discussion: DD increases one's risk of crashing. Public awareness campaigns endorsed by application developers should consider making drivers aware of the risks of using cell phone applications while driving. Cell phone mitigation software could inhibit the use of applications for drivers.

Sharonne Hayes
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Ronald E. McNair Program
Mentors: Dr. David Schwebel, Aaron Davis

An Analysis of Multiple Respondent Agreement in Reporting Adolescent Media Use and How Agreement Relates to Adolescent Pedestrian Behavior

Introduction. Extensive research conducted on the influence of media has highlighted especially its impact on contemporary culture. With increasingly broad use seen among adolescents, parent awareness of the magnitude of teen media usage is being scrutinized. Recent research has also focused on multiple respondent agreement, assessing the difference in how participants report behaviors themselves compared to how others report on the same construct. This study focuses on multiple respondent agreement on media usage, assessing how adolescents report their level of usage compared to how their parents report it on them. We also consider whether discrepancies in reporting are associated with decreased performance in certain basic, everyday tasks. **Methods.** Adolescents completed a media usage scale and their parents completed both a media usage scale and a brief demographics survey. Adolescents also performed on a virtual road environment (VR) that determines level of pedestrian street-crossing safety skills. Teens performed this task after their previous night's sleep was restricted to 4 hours. **Results**. We expect three primary results: (1) a discrepancy between parent and adolescent report of media use, with X reporting more use than Y, (2) larger discrepancies in media use reporting respective to the demographic characteristic of income and race over others, and (3) larger discrepancies in media use reporting will correlate with a lower level of performance in the VR. **Discussion**. Further study on multiple respondent agreement should consider other relationships among people, other variables such as parenting style and geographical location, and elaborate on other possible harms of such respondent discrepancies.

Adrian Jones
University of Alabama at Birmingham
Ronald E. McNair Scholars Program
Mentors: Dr. Qin Wang, Christopher Cottingham

Desipramine modulates Norepinephrine- elicited ERK signaling through the α_{2A}- adrenergic receptor

Depression is an extremely complex disorder of mood and personality which is mainly treated by antidepressant drugs. Although these drugs generally work by affecting the concentration levels of two chemical messengers in the brain, norepinephrine (NE) and serotonin, their underlying mechanism of action needs to be further delineated. Improved understanding of how such drugs work will in turn improve future treatments for depression. Receptors in the brain mediate the cellular effects of the chemical messengers. The current study is focuses on one particular receptor in the brain, the alpha-2A adrenergic receptor(AR) which is a G-protein coupled receptor that binds NE. Akt and Erk are downstream signaling molecules for the alpha-2A AR, and are activated when NE binds to the receptor. We hypothesize that the antidepressant DMI, a noncompetitive agonist, can modulate NE induced downstream signaling. In this study, we have examined DMI for effects on NE-induced signaling through dose dependent response analysis and the kinetics of NE induced signaling through time course analysis. A Western Blot procedure is used to evaluate the activation of ERK and Akt by the alpha-2A AR in MEF cells stimulated with NE, alone or in combination with DMI. Active forms of ERK and Akt were detected with appropriate primary and secondary antibodies. We found that both the dose-response curve and time-course of NE-induced ERK and Akt activation are changed in the presence of DMI. We conclude that DMI modulates NE induced downstream signaling.

Sierra Nicely
UAB
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Dr. Shelia Cotten, William Anderson

Differences in Computer and Internet Usage Among Assisted and Independent Living Residents

While many people are using computers and the internet as an effective part of their life some people are still on the wrong side of the digital divide. This lack of computer and internet knowledge could limit the connections and interactions with other people. One group that this can limit is older adults living in assisted and independent living communities. The research will use a combination of direct survey and literature review. The purpose of this research is to observe the differences between assisted and independent living in their interactions with computers and the internet.

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Ronald E. McNair Scholars Program
Mentors: Olivio J. Clay, Ph.D., Michael Crowe, Ph.D., Fernando Ovalle, Ph.D.

Physician distrust and perceived discrimination as potential mediators of the relationship between race and diabetes distress

Background: Type 2 diabetes is a metabolic disorder characterized by high blood glucose and relative insulin deficiency. Diabetes affects over 25 million Americans, with 95% of the cases having type 2. African Americans are twice as likely to be diagnosed with diabetes than non-Hispanic Caucasians, and tend to have more general emotional distress than Caucasians. Higher ratings of physician distrust and perceived racial discrimination have been identified as possible explanatory factors. The current study examines these relationships for diabetes-related distress.
Method: Older adults from the Diabetes and Aging Study of Health (DASH) participated in a telephone interview and answered questions about feeling overwhelmed with the demands of living with diabetes or failing in diabetes routine. They also reported on experiencing any discrimination due to race/ethnicity within the last 12 months and how much they felt they could trust their physician.
Results: The sample was composed of 181 adults with Type 2 diabetes (mean age= 74.4, range = 65-90). Forty-one percent were African American and 38% were males. Multiple regression analyses revealed that after controlling for age, gender, and education, being African American was associated with higher levels of diabetes-related distress ($\beta = .19$, $p = 0.02$). The relationship between race and distress was non-significant when both perceived racial discrimination and physician trust were included in the model ($\beta = .16$, p = n.s).
Conclusion: These results suggest that racial discrimination and physician trust among African Americans are important factors to consider in studies of health disparities and diabetes.

Social & Behavioral Sciences and Public Health II—Exhibit 34

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Ronald E. McNair Post-Baccalaureate Achievement Program
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Effect of IQ and Text Message Length on Distracted Driving Performance

Statement of Purpose: To assess the effect of text message length on driving performance among persons with varying IQ scores. **Background:** Research suggests IQ may be related to driving performance; and, that multitasking unequally splits attention across tasks being performed.[1-3] Moreover, in dual task conditions, task prioritization occurs.[4] This study examined prioritization by measuring simulator-based driving performance as the primary task and text message length as the secondary task. **Method:** 43 teens were administered the Wechsler Abbreviated Scale of Intelligence. Number of crashes occurring while driving a simulator and texting were documented. Text message length scores were computed to examine whether text indicated prioritization. Regression was used to determine whether (1) intelligence was predictive of crashes and/or text message length; and, (2) whether text message length was predictive of crashes. **Results:** Intelligence was marginally predictive of crashes while driving a simulator and texting. More crashes occurred while texting among subjects with lower IQs (β=-.33, p=.06,). While driving and texting, subjects with lower IQ scores sent shorter length texts (β=.42, p<.01,). Text length was not predictive of crashes (β=.03, p= n.s.). **Discussion**: Some who text while driving may allow driving to become the secondary task, although not captured in this study using text length as an indicator. Lower IQ may be correlated with increased crashes during distracted driving, regardless of text length. Therefore, subjects with lower IQs may benefit from targeted distracted driving interventions. Future research should explore whether shorthand texting or content is a better predictor of crashes.

Social & Behavioral Sciences and Public Health II—Exhibit 35

John Smith
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Mentors: Dr. Dale Dickerson and Dr. Michelle Fannuchi
Ronald E. McNair Post-Baccalaureate Achievement Program

The Toxicity of Silver Nanoparticles

Silver nanoparticles have been recently introduced into our everyday life, through the biomedical, biotechnology, and textile industries. These particles are used specifically for their anti-microbial properties and have now shown up in increasing amounts in our wastewater treatment plants. Although these particles are now common in our biological ecosystems, little is known about their toxicity. The goal of this study is to specifically test the effects of silver nanoparticles (of average size diameters 10, 40, or 100 nm) on human bronchial epithelium (HBE 1) cells. The effects of these particles on HBE 1 cells will be determined by measuring the cellular reductase activity of treated cells using the MTT toxicity assays (an indirect but common measure of cell survival to determine overt toxicity), intracellular GSH levels, and OCAR/ECAR readings (oxygen consumption rate/ extracellular acidification rate). Silver nanoparticles of 40 or 100 nm were found to have no overt toxicity (MTT assay).

Evan Black
Lenoir-Rhyne University
REU Program
Mentors: Dr. Haibin Ning, Dr. Selvum Pillay

Flexural Properties of Fiber Reinforced Composites at Elevated Temperature

The research is focused on the measurement of mechanical properties of long glass fiber reinforced thermoplastic composites at elevated temperature. Testing samples are prepared using a compression molding technique. Processing parameters such as extrusion temperature, mold pressure, mold temperature, and cooling time are optimized to obtain well-consolidated composite samples. A heating chamber is built and provides the elevated-temperature environment for the flexural testing. The samples are tested at various temperatures including room temperature and glass transition temperature of the polymer matrix to obtain the tensile and flexural strength at these temperatures. Finally, the flexural and properties of the composite samples are compared and the results are to provide the design guideline for the application of the composites at elevated temperatures.

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Superconductivity of Iron-Selenium Compounds at High Pressures

The discovery of superconductivity in Iron-based layered superconductor $La[O_{1-x}F_x]$ FeAs (x = 0.05–0.12) in 2008 with T_c = 26 K led to a world-wide research effort in these novel materials. Currently, the highest temperature that superconductivity has begun in the Fe-based superconductor $Sm[O_{1-x}F_x]FeAs$ is 55 K, further efforts are ongoing to synthesize novel iron-based superconducting materials and understand their properties. The simplest of iron-based superconductors is iron-selenium compound $FeSe_x$ and it is critical to understanding and designing new materials. In addition, application of external high pressure can enhance superconducting transition temperatures and allows us to investigate the effects of reduced intermolecular spacing without chemical modification of the compound.

We are studying $FeSe_{1.01}$ and $FeSe_{0.80}$ to uncover correlations between increases in superconductivity and properties of these compounds by examining the onset of superconductivity at high pressures. We have carried out measurements in a diamond anvil cell device to a pressure of 27 GPa and temperature of 10 K. We have found that $FeSe_{1.01}$ and $FeSe_{0.80}$begins superconducting under ambient pressure at 11 K and increase to 34 K at 5-9 GPa and 40 K at 11 GPa respectively. The results for $FeSe_{1.01}$ match results from other groups, but the results from $FeSe_{0.80}$ are unexpected. It is thought that $FeSe_{1.01}$ is the best FeSe superconductor, but not only does $FeSe_{0.80}$ surpass it, it also superconducts strongly above 10 GPa. This suggests that our understanding of superconductivity is incomplete and further crystal structure determination is needed at high pressures and low temperatures to correlate observed superconducting transitions with changes in FeSe tetrahedral bonded layers and consequent changes in electronic structure.

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University of Missouri-Columbia
Physics Department REU
Dr. Shawn Gilbert, Dr. Alan Eberhardt and Joseph Schwertz

Shear strength testing of the growth plates of developing mice

Injuries to the growth plate can inhibit the growth of children and obesity may affect the strength of the growth plate. To determine if obesity affects the strength of the growth plate it is first necessary to establish a method of testing the growth plate. Femurs from developing mice were obtained and stored in the fridge in saline. Muscle and connective tissue was removed from the femurs with a scalpel. The femurs were then positioned horizontally with the chondyles exposed so that there was shear loading in the medial to lateral direction. A jig similar to what was used in a previous studie was made. Poly(methyl methacrylate) was used to hold the bones in the jig and prevent movement. The axial force required to shear the distal growth plate was applied and measured using an 858 Mini Brumo from MTS systems in Eden Praries, MN and a 100N load cell. The axial force that was measured ranges from -2.95N to -14.58N. However, in the first three tests, the femurs did not break at the growth plate. In the last test it is possible that the break was through part of the growth plate. Sanderson's Rapid Bone Stain with a Van Gieson's counter stain will be used to find where the growth plate is. This will allow the bone to be held closer to the growth plate so the applied force will break the bone through the growth plate, not through the diaphasis. This method will ultimately be used to test if obesity reduces the strength of the growth plate in mouse models.

John C. Owens
Emory University
UAB Physics REU Program
Co-Authors: Jeffrey Montgomery, Dr. Vohra

Electrical Resistance of Rare Earth Metal Thulium under High Pressure

The purpose of this experiment is to study the structural phase transitions of rare earth metals by measuring the resistance of a metal sample as the pressure on the metal is increased. As pressure on a metal increases, the resistance of the metal should decrease because the electron density is increasing. At the phase transition, the resistance verses pressure graph should have a sudden change of slope (the direction and magnitude depends on what type of change in phase is occurring) since a structural changes would lead to change in electronic properties. For our experiments we looked at Thulium first, since Thulium undergoes a phase transition at 14 GPa from a hcp phase to a Sm-type phase. We used a diamond anvil cell with diamonds that have a culet size of 250 microns. The designer diamond had four probes lithographically printed on the culet so that resistance across the sample can be calculated by measuring voltage and current across the sample with two different sets of parallel probes. In each experiment, a gasket (either rhenium or steel) was first pre-indented and drilled with an 80 micron hole. The thulium sample was then cut and packed into the hole. In order to measure the pressure of the sample, we inserted a approximately ~10 micron ruby on top of the sample. The pressure was then measured using a Dilor Raman spectrometer, via the standard ruby fluorescence method. While we were using a steel gasket, we had difficulty detecting thulium's transition due to several properties of steel. First, iron is more conductive than thulium. Second, iron has a phase transition between 13-16 GPa that overlaps with the material of interest. However, when we used a rhenium gasket which is more resistive and has no transition at these pressures, we measured a linear decrease in resistance as pressure increased with a sudden change of slope in the resistance versus pressure graph at 13.8 GPa, at which the resistance began to increase. This is plausible because thulium undergoes a transition from a two hexagonal close packed layered structure with less scattering to a nine-layered structure with more scattering. From this we conclude that measuring resistance of rare-earth metals at high pressures is a possible method not only to detect structural phase transitions but also get additional information about their electronic structure.

Rashidra R. Walker
University of Alabama at Birmingham
Ronald E. McNair Scholars Program
Mentor: Jason Linville, Ph.D

Detection of Cocaine and Methamphetamine in Dog Hair Combings using Gas Chromatography/Mass Spectrometry

Animals may be kept in an environment where they can be exposed to powdered drugs such as cocaine and methamphetamine. Once airborne, these drugs can be ingested through the mouth or nose, and even deposited on the animal's fur. The aim of this research is to develop an efficient method to extract these drugs from the surface of dog's fur. If these drugs are detected in blood or hair combing samples of dogs, then the owner (s) may be prosecuted for animal cruelty. Several hair combings were spiked with cocaine and methamphetamine and were tested using different extraction methods. Since this research was focused on exposure and not drug usage, the hair was not processed by a cleaning method. Only the drug extracted from the outer surface of the hair was tested. Three extraction methods were compared to determine which method resulted in the largest peak areas in a gas chromatogram and the highest quality of mass spectrum. The methods used in this research were acid/base extractions followed by an organic extraction step to dissolve the drugs for analysis using Gas Chromatography/Mass Spectrometry. This research is still in progress, so no results have been obtained.

Zachariah Mahler Ingram
University of Alabama at Birmingham
UAB Department of Chemistry Summer Undergraduate Research Fellowship
Mentor: Dr. Aaron Lucius
Coworkers: Clarissa Weaver, Jia Bei Lin

An Assay for Observing Hydrolysis of ATP Catalyzed by *Escherichia coli* ClpB

ClpB (98 ,000 Da monomer) is one of many ATP dependent motor proteins which exist in the cytoplasm of cells. More specifically ClpB is a hexameric molecular chaperone with the ability to disaggregate stress-denatured proteins. The function of this disaggregation machine is to disrupt protein aggregates and allow them to refold or hand them off to a chaperone that can aid in protein folding. Kinetic studies of phosphate-liberating enzymes, performed by others, relied primarily upon the use of discontinuous assays, but to gain both precision and time efficiency a continuous assay was developed. The first portion of this assay is the hydrolysis of ATP by an ATPase which creates inorganic phosphate and ADP. The second portion capitalizes on the presence of inorganic phosphate with the use of purine nucleoside phosphorylase PNPase. The PNPase uses inorganic phosphate to catalyze phosphorolysis of the 7-methylinosine producing hypoxanthine and ribos-1 phosphate. Upon phosphorolysis an absorbance change at 291 nm is observed because 7-methylinsone absorbs at 291 nm and the products, hypoxanthine and ribose-1 phosphate, do not. The research that I'm performing involves the use of this assay to examine ClpB catalyzed ATP hydrolysis.

Derek Caplinger
The Pennsylvania State University
Mentor- Dr. Catledge
Physics REU program

Characterization of Electrospun Poly(L-Lactic Acid) fibers Reinforced with Cellulose Whiskers

Previous studies have shown that it is possible to use small discontinuous polymer fibers in high performance concrete to help improve the fracture toughness of the cement, thus creating so called "bendable concrete". The goal of this project is to determine the feasibility of applying these principles for injectable bone cements which typically suffer from brittle fracture and insufficient load-bearing capacity. This project involves electrospinning nano-scale polymer fibers that would be cut to specific lengths and incorporated into commercially used bone cements in the hopes of improving the mechanical properties of said cements. It is also a goal of this project to incorporate cellulose nano-whiskers having extremely high elastic modulus into the polymer fibers. This is expected to serve a dual role: (1) to increase the fiber/matrix frictional bond strength and (2) to increase the overall load-bearing and toughness properties of the bone cement mixture. To date we have electrospun Poly lactic-glycolic acid (PLGA) fibers (with and without cellulose whiskers) and Poly-L-lactic acid (PLLA) fibers with no cellulose whiskers. Future work in this project includes electrospinning samples of PLLA with cellulose whiskers in the solution, and characterization of the fibers to demonstrate cellulose whisker reinforcement, structure and mechanical properties. Characterization methods will include Atomic Force Microscopy, X-Ray Diffraction, Raman spectroscopy, and FT-IR spectroscopy. It is also a goal to run dynamic mechanical analysis to evaluate potential improvement in adding the fibers to a cement matrix.

Matthew Miller
Rhodes College
Physics REU program
Mentors: A. Stanishevsky, M. Walock, Y. Zou
University of Alabama at Birmingham

Chemical and Structural Transformations in WO3 and WO3/C Nanoparticles Annealed in Reducing Atmospheres at Low Pressure

Nanosized tungsten oxide has found to be a very useful material for applications in gas sensors, electrochromic devices, and photocatalysis. In turn, tungsten carbide nanoparticles with the catalytic properties similar to those of platinum group metals have been demonstrated to possess the catalytic properties similar to those of platinum group metals. However, the synthesizing of both tungsten oxide and tungsten carbide nanoparticles with the combination of properties most beneficial for intended applications still presents numerous challenges.

In this work we investigated the conversion of hydrothermally derived pure and carbon-coated WO3 nanoparticles into tungsten carbide particles using the thermal and microwave plasma annealing of oxide nanoparticles at reduced pressures in hydrogen, hydrogen/nitrogen, and hydrogen/methane mixtures. Tungsten oxide nanoparticles were precipitated onto silicon wafers and introduced into either microwave plasma-assisted or in hot filament chemical vapor deposition apparatus commonly used for diamond films fabrication and processed for up to 5 hours. The annealing temperatures and pressures were similar to the conditions typically used for the synthesis of poly- and nanocrystalline diamond films. We examined the effects of annealing temperatures and gas atmosphere on the rate of WO3 conversion to other phases. It has been found that the complete reduction of the tungsten oxide nanoparticles to metal or stoichiometric carbide nanoparticles can be achieved under appropriate conditions. The advantages and limitations of each used method are discussed in detail.

We acknowledge the support of this work from the National Science Foundation Grants DMR-0806521 and DMR-1058974.

Sewada M. Reese
Stillman College
REU/RET Program
Mentors: Patrick TJ. Hwang, Dongjin Lim, and Ho-Wook Jun
Comprehensive Diabetes Center University of Alabama at Birmingham, Birmingham, AL

Developing a bio-inspired hybrid sack for the delivery of pancreatic islets and FGF-1 to improve islet engraftment at the omentum site

The omentum site is an appealing transplantation site in pancreatic islet transplantation. It can accommodate a large islet volume, some immune privilege, and coexisting use of transplant devices. However, revascularization is one of the major issues with pancreatic islet transplantation due to low vascularity at the omentum site. Fibroblast growth factor 1 (FGF 1) has shown to be a good source to induce mitosis for endothelial cells and stimulate angiogenesis. Islet revascularization could be enhanced by the controlled release of FGF 1 at the omentum site. An initial burst release of FGF 1 can help stimulate angiogenesis, and a sustained release of FGF 1 can help surround the transplanted islets with a stable vascular network. Therefore, in this study, a hybrid sack was developed. It consisted of islets encapsulated within a self-assembled peptide amphiphile (PA) nanomatrix gel and placed within a microporous, biodegradable electrospun poly-caprolactone (ePCL) sack. The proliferation of human umbilical vein endothelial cells (HUVECs) was significantly higher with FGF 1, and the release profile of FGF 1 from the hybrid sack, was measured by an ELISA assay, and showed an initial burst followed by a sustained release. These results demonstrated that the hybrid sack has a great potential to enhance islet engraftment and vascularization at the omentum site.

Rose Kathryn Sackuvich
University of Kansas
REU in Materials Science
Mentors: Dr. Vladimir Fedorov, Jeremy Peppers

Spectroscopic characterization of the chromium and titanium doped $AgGaS/Se_2$ crystals for mid-IR laser applications

Developments of new tunable laser sources for the "molecular fingerprint" mid-IR spectral region (2-20mm) are in great demand for many medical and bio-sensing applications. Recent progress demonstrated in transition metal doped II-VI tunable solid state lasers based on Cr^{2+} and Fe^{2+} ions in the tetrahedral crystals host allows cover broadband laser tunability between 1.9-3.3 mm and 3.9-6 mm correspondingly. However, the development of new laser materials for laser tunability between 3-4 mm and with wavelengths longer than 6 mm is still under progress. In this paper the spectroscopic characterization of transition metal doped $AgGaS_2$ and $AgGaSe_2$ crystals with coordination number four are reported. Absorption and luminescence spectroscopy of chromium and titanium doped crystals were measured at room temperature, and additional polarized room and low temperature measurements of the titanium doped $AgGaS_2$ sample were taken. Broad emission spectra between 3 μm and 6 μm were observed in both Cr and Ti samples when using a 1.9 mm laser source. The Ti doped sample reveals present in both 1+ and 3+ oxidation states sliver and gallium sites correspondingly. This crystal could be used as a passive Q-switcher for solid state lasers operating near 2mm.

Deondra Scott
University of Alabama at Birmingham
McNair Scholars Program
Mentor: Alan Eberhardt

Contact Pressures in the Knee with and without the Meniscus

The meniscus acts as a cushion in the tibiofemoral joint and plays an important role in stabilizing the knee for everyday function. The knee experiences forces ranging from 2.7 to 4.9 times the person's body weight during normal walking, stair-climbing and running. Without the meniscus, the stresses (force/area) on the cartilage of the tibiofemoral joint are increased and may result in joint disorders such as osteroartrithis. The meniscus has limited vascularity and when damaged, factors such as the amount of damage or age affect how easily it repairs itself. As a result, some patients with meniscal injuries have a partial or full meniscectomy, which causes stresses on the knee to increase.

Tissue engineered materials are being tested and compared to the real meniscus to determine if they can be used to replace the meniscus in the knee. The purpose of the present study is to measure the contact pressure in the knee with and without the meniscus. In order determine these pressures, a full knee testing model will be constructed and Fuji film will be calibrated to test the pressures. If this test is successful, it will be used to test whether these tissue engineering materials can replace the meniscus in the knee.

Alex Skinner
University of Alabama at Birmingham,
UAB Physics – Research Experiences for Undergraduates (REU),
Mentors: Dr. Renato P. Camata, Eric H. Remington

Development of Novel Thin Film Electrolyte Materials for Intermediate Temperature Solid Oxide Fuel Cells

Solid oxide fuel cells (SOFCs) are electrochemical devices that convert chemical energy into electricity using ion-conducting oxide ceramics as electrolytes. We are developing two new electrolyte materials to reduce the operating temperature of SOFCs and expand their applicability in clean power generation: (1) Gadolinia-doped ceria coated with yttria-stabilized zirconia thin films (a three-layer electrolyte); and (2) Thin films of gadolinium-doped barium zirconate (a proton conductor). Pulsed laser deposition (KrF; 3-6 J/cm^2) is used to deposit these materials on suitable substrates in a 200-800 mTorr oxygen environment. Crystalline structure and thickness of films are determined by X-ray diffraction and transmission spectroscopy.

Stanley Cochran Jr.
Morehouse College
REU Program
Mentors: Dr. Pillay, Dr. Ning, Qiushi Wang

Mechanical Properties of Fiber Reinforced Composites at Elevated Temperature

The research is focused on the measurement of mechanical properties of long glass fiber reinforced thermoplastic composites at elevated temperature. Testing samples are prepared using extrusion-compression molding technique. Processing parameters such as extrusion temperature, mold pressure, mold temperature, and cooling time are optimized to obtain well-consolidated composite samples. A heating chamber is built and provides the elevated-temperature environment for the tensile testing. The samples are tested at various temperatures including room temperature and glass transition temperature of the polymer matrix to obtain the tensile strength at these temperatures. Finally, the tensile properties of the composite samples are compared and the results are to provide the design guideline for the application of the composites at elevated temperatures.

Justin Smith
University of Alabama at Birmingham
Summer 2011 Physics REU Program
Mentor: Dr. Joel Berry

Research on Coronary Stents

This experiment is being performed to find a model of a coronary stent which creates less obstruction to the flow of blood when placed within an artery. When a coronary stent is placed in an artery, the stent can itself creates an obstruction of blood flow along the wall of the artery. This obstruction can cause a buildup of platelets and fibrin, which can cause thrombosis to reoccur in a patient. We will conduct the experiment in three different phases, in-vitro, in-vivo and finite element analysis. All of these methods will be using models of stents which we created. By the end of our research phase we hope to find a less obstructive design of a coronary stent for use in live patients. This will in turn improve the length and quality of the lives of patients who have received a coronary stent.

Hannah Whitaker
Carson-Newman College
Summer Program: REU- Experimental and Computational Materials Research
Mentor: Dr. Joseph Harrison

BCS Model Parameters for $BaFe_2As_2$

$BaFe_2As_2$ is one of several "122" or iron-pnictides that form a new category of high-temperature superconductor. Many questions exist as to the mechanism of "Cooper pairing" in these systems. Although it is fairly certain that the standard BCS model does not apply to these systems, it is nevertheless instructive to compare them on the basis of the BCS model to see to what extent they fall outside the traditional electron-phonon coupling mechanism. In the BCS model two dominant factors that determine the superconducting transition temperature, T_c, are N(0), the density of electron states at the Fermi level, and ω_D, the Debye frequency for the solid. While doping of these compounds is often used to modify the superconducting properties, Vohra, *et. al*. have found that certain compounds become superconducting under pressure. In this work we use a full potential linear-muffin-tin-orbital (FP-LMTO) program (LmtART) to calculate both N(0) and ω_D and to study changes in those parameters as a function of lattice constant to simulate the effect of pressure. We will interpret changes in those traditional coupling parameters in light of the observed changes in superconducting properties with pressure.

Joshua Harris
UAB
Ronald E. McNair Scholarship Program
Mentor: Edward Morris

Development of Robotic Capabilities through Experimental Labs

A robot is a mechanical intelligent agent, which can perform tasks on its own, or with guidance. In practice, a robot is an electro-mechanical machine guided by computer. As such, a robot's performance is dependent on the quality of the driving software's programming. Though the idea of using robots for manual labor is easy in theory, robots' abilities must be tested and monitored for optimal function. The objective of this study is to develop a protocol for testing the mobility, activity, precision, and programming of the Microbot Teachmover. The Microbot has a base that the device sits on. The shoulder connects the shoulder to the upper arm, from that the upper arm connects to the elbow then down the forearm to the wrist, which has grips that opens and closes, similar to a model of a heavy duty crane. In the lab protocol, the robot is programmed to exhibit its many capabilities through manual control or computer programming. The program is prewritten, and a computer delivers the program to the robot that, then, carries out the program. In our studies, we found that programming the Microbot is a most difficult and tedious task. I am improving the software debugging process by breaking down the codes into simpler forms. Only when the program is able to run smoothly and without any misreads will the robot fulfill the program and carry out its tasks.

Jeremy Sheppard
Georgia Institute of Technology
Summer in Biomedical Science (SIBS)
Mentors: Timothy Wick, Joel Berry, Susan Rupert

Engineered polycaprolactone and cellulose substrates for MCF-7 F-108 co-cultures

Several studies have used 3D cell volumes to study established breast cancer cell lines. This project was designed to develop a co-culture of MCF-7 breast cancer cells and F-108 primary breast fibroblasts in a 3D volume on a biocompatible substrate. The MCF-7 cell line was engineered to express Vascular Endothelial Growth Factor (VEGF) from a doxycycline-inducible promoter and β-galactosidase constitutively. MCF-7 xenografts in mice treated with doxycycline have been shown to develop highly vascularized, desmoplastic, tamoxifen-resistant tumors which metastasize to the lungs. MCF-7 xenografts without doxycycline treatment grew into significantly smaller, non-metastatic tumors which responded well to tamoxifen. To replicate the behavior observed in vivo as recorded in existing literature, co-cultures were grown on polycaprolactone and cellulose scaffolds. Porous polycaprolactone (PCL) fibers were manufactured via electrospinning with salt leaching. Bacteria-grown cellulose disks were provided through collaboration with Chalmers University of Technology, Gothenburg, Sweden. A time course was run on cell co-cultures seeded onto each material with four treatments; with both, each, and without doxycycline and tamoxifen. MCF-7 cell proliferation was quantified using a β-galactosidase enzyme assay. Cell counts were used to determine whether or not the cultures exhibit increased proliferation and tamoxifen resistance under VEGF expression. This project serves two main purposes. The first is to have a functional model system for studying the role of Notch-1 signaling in VEGF-induced MCF-7 antiestrogen resistance. It is hypothesized that stromal cells produce the Notch ligand DLL-4 in response to VEGF, and that it binds to Notch-1 receptors on MCF-7 cells, actuating Notch signaling and inducing cell proliferation. The second is to establish the utility of electrospun polycaprolactone as a substrate for growing cancer cells for study in vitro. Further imaging may help to elucidate how MCF-7 and F-108 cells aggregate and grow into their culture substrates.

Honors Academy Leadership Projects—Exhibit 53

Dustin Bowen and Laura Ann Brown
UAB
UAB Honors Academy Prime Time Leadership Course (HAC301)
Mentor's name and the names of others involved with the project: Dr. Bradley Newcomer (mentor) and Dr. Rajesh Kana (primary stakeholder)

UAB Honors Students' Initiative for Autism Research

Community Partner or Stake-holder - Dr. Rajesh Kana is a UAB professor of psychology and a modern pioneer of autism research. His research team works to better understand autism and to search for methods of treating it more effectively. This is his mission, and is set forth to aid all persons affected by autism; more specifically, those who seek treatment at UAB.
Summary of Project and its Potential Impact - Our project is philanthropic in nature. We plan to host a three-day philanthropic event in the Greater Birmingham area to raise awareness and funds for Autism Speaks and "at home" autism research institutes, like that of Dr. Kana in Birmingham. At the closure of our project, we hope to have raised a minimum of $1,000.00 for autism research and to have increased public awareness.
Challenges and Rewards - The greatest challenge, as with any philanthropic event, is gaining the support, donations, and recognition needed for a successful event. However, through dilligence and persistence, we will see the benefits of our endeavors through the lives of those benefiting from the research being done on autism.
Personal and Academic Growth through your project experience - Teamwork, resourcefulness, advertising, and networking are all traits which we have strengthened as a result of this project. While working with researchers, collaborating with venue hosts, and marketing our project, we have bonded as a team and have used the resources accessible to us to our advantage. This translates into academic growth through our understanding of patience, commitment, and strong work ethics. These values, strengthened by this project, have benefited the recipients of the funds, our group, and UAB and the Honors Academy.

Honors Academy Leadership Projects—Exhibit 54

Jarrod Collins
UAB
UAB Honors Academy Prime Time Leadership Course (HAC301)
Mentor's name and the names of others involved with the project: Dr. Diane Tucker

A Guide to UAB EXPO

The purpose of this project is to create a resource which future coordinators of the UAB Spring Exposition of Undergraduate Research can use in order to ease the process of organizing the UAB EXPO. The guide is primarily meant for faculty and students who may be involved with leading the EXPO. This guide is meant to impact the undergraduate students that wish to present at EXPO. The goal of the project is to give the coordinators of EXPO a resource that they can use to continue to make changes and improvements – continuing to make the UAB EXPO bigger and better each year. I came across many challenges while organizing the Spring 2011 EXPO and hope to reflect upon those challenges and pass the knowledge along to future organizers. I feel that coordinating this past year's EXPO has developed me into a confident leader. Months of work, organization and communication were needed in order to execute the event and I believe that every bit of the hard work was worth it. The 2011 Spring EXPO incorporated more projects and more students than ever before and it was my honor to be a part in organizing this event for fellow students.

Honors Academy Leadership Projects—Exhibit 55

William C. Anderson
UAB
UAB Honors Academy Prime Time Leadership Course (HAC301)
Mentor's name and the names of others involved with the project: Vicko Alvarez, Robert G. Corley

What to know about SODEXO

Community Partner or Stake-holder - United Students Against Sweatshops (USAS) is my community Partner.
Misson: United Students Against Sweatshops is an international student movement of campuses and individual students fighting for sweatshop free labor conditions and workers' rights. We define 'sweatshop' broadly and recognize that it is not limited to the apparel industry, but everywhere among us. The USAS works to develop the autonomy of students and individuals around the country that are interested in solidarity with worker's struggles.
Summary of Project and its Potential Impact - Our mission is to raise awareness about the company providing food services on campus at UAB. While raising awareness we hope to facilitate discussion about possible solutions for UAB's food service future. We are hoping to make UAB reconsider its choice in food services.
Challenges and Rewards - I have had a great difficulty trying to find the appropriate sources for information. I was often directed to the wrong offices and the wrong people. Now I know the proper venues to go about retrieving information. I am still awaiting my response from UAB about the contract. It has been very rewarding to work with organizers and students around the country who have been supportive and kind. They have certainly helped guide my path.
Personal and Academic Growth through your project experience - I have learned that despite initial pre-judgments about how easy something may or may not be, you never really know. My whole project is centered around the details of the contract between Sodexo and UAB. It has taken way longer than expected. I will continue on past the extent of this class pursuing my project goals.

Honors Academy Leadership Projects—Exhibit 56

Alexandria Sheppard
UAB
UAB Honors Academy Prime Time Leadership Course (HAC301)
Mentor's name and the names of others involved with the project: Suzanne Scott-Trammel and Beth Hunter

Work Study

Community Partner or Stake-holder - Career Services engages students in the career development process of exploring career options, gaining experience in a chosen field, preparing for the job search, and succeeding in their career goals.
Summary of Project and its Potential Impact - Our objective is to create an informational PowerPoint/Flash Video of Q & A's about Work Study for UAB websites. This is in order to get all the information about Work Study into one place.
Challenges and Rewards -

- Coming up with all the information (Research in different departments)
- Getting conflicting information
- Learning more about the Work Study Program as a whole and at UAB and how rewarding it is as a program that offers financial assistance along with professional experience.

Personal and Academic Growth through your project experience -

- The number of questions about work study that students come up with increases everyday.
- Students get frustrated when they cannot find information they need, but this problem can be easily fixed by getting as much information in one place as possible.
- It is a collaboration of students, parents, UAB faculty & staff, Career Services, and Financial Aid that makes up Work Study.
    - The student wants a Work Study position to help pay for college.
    - Their parents may take part in helping fill out FASFA forms.
    - UAB Faculty & Staff post positions on Career Services website (DragonTrail).
    - Students must secure a position in order to get funds from Work Study.
    - Students must be eligible (need-base) for Work Study.
    - Financial Aid determines if the student needs the funds and allots the funds accordingly.

Uma Srivastava
UAB
UAB Honors Academy Prime Time Leadership Course (HAC301)
Mentor's name and the names of others involved with the project: Mitul Patel

Baking for Volleyball

Baking for volleyball was all about giving back to the local volleyball community. They promote staying fit and in shape by playing volleyball once a week. They are always in need of funds so I thought about supporting them. This was done through a bake sale. All proceeds went towards the organization. Initially there were some challenges about getting everything together, and figuring out what to do but it all came together. I've learned that helping at any level is beneficial. Giving back to the community doesn't have to be about donating $500; it can also be at smaller levels. The organization's name is Indian Birmingham Volleyball Association. I was directly in contact with Mr. Mitul Patel who is chair of this nonprofit organization.

Danielle McDavid, Stephanie Arana, Rosalind Boonarkat
UAB
UAB Honors Academy Prime Time Leadership Course (HAC301)
Mentor's name and the names of others involved with the project: Katrinia Pigler- Evercare Hospice & Palliative Care Volunteer Coordinator, Robert G. Corley- Director of Global Community Leadership Honors Program, Dr. Newcommer- Director of ELSP Honors.

4th of July Activity Party for the Elderly

As all of us age, we face the inevitability of one day losing our ability to care for ourselves in a safe manner. Many of the elderly are placed in nursing homes, causing them to feel abandoned by family and stripped of their independence. Our project focuses on providing elderly with support, individualism, and comfort by creating an ergothrapy program in which residents of nursing homes and hospice centers can interact with college students. By partnering with the Evercare Hospice and Palliative Care and their volunteer coordinator, Katrinia Pigler, both programs are dedicated to providing the best care available and reducing the physical and emotional pain of residents and family. The physical interaction with college students stimulates the residents and improves there emotional well being, yet challenges such as mobility and speech impede the project. Once these challenges are overcome, the students are able to gain respect and admiration towards the elderly and the elderly are given a chance to regain their independence. Our current college project members have gained a new found respect for the elderly, while gaining a wider understanding of how the health care system works. If more college students were to participate amongst nursing homes and hospice residents, the elderly would have a chance to focus on the beginnings of a friendship, not an end, as college students gain a broader perspective on life.